AUTHOR COMMENTS

We would like to thank the reviewer for his/her constructive comments. We have responded and amended the manuscript as described below.

ANONYMOUS REFEREE #2

General Comments

This paper describes the authors' investigation to identify the extent of damages from the satellite images and attempts to validate the method of their visual inspection by comparison of the site investigation. The attempt is potentially meaningful and useful particularly during a disaster-relief work. However, at this stage, the manuscript seems to fail in describing details of their methodologies, and also it is unclear whether the methodology was really confirmed or not. The authors should further refine the paper, including the points such as mentioned below.

Major comments #1

Roofs could be blown by either strong winds or storm surges. The authors should mention most likely mechanisms to cause the roofs destroyed.

Author's response

During the first stage of response described in the paper, the building damage visual inspection in satellite images, it is the main objective rapidly grasp the impact instead of making a separation of roofs damaged by strong winds or storm surge. However, during the field survey, such description, as accurately pointed out by the reviewer, is important to be included to comprehend the characteristics of the event. Therefore, it was in page 8 lines 22 to 28 where we described the major mechanism of damage to roofs caused by the wind due to the lightweight characteristic of roofing materials in most of the areas affected. Other than that, for washed away houses very near to the shore, it was not possible to distinguish the first source of damage to the roof.

Author's changes in manuscript

No changes were made in the manuscript.

Major comments #2

How was the damage defined if a house was damaged by storm surge, while its roof was intact? If there exist a number of houses with structural damage, but without any visible damage in roof, visual inspection based on satellite images doesn't seem to work to estimate actual extent of damage in the affected area.

Author's response

Thank you for your comment. It is an accurate observation, which is indeed a limitation of the visual interpretation of satellite images. In this study, due to such uncertainty on the damage condition in buildings with no apparent changes in the roof but inside flooded areas, the lower level of classification includes a "low damage" interpretation or a 'survived" interpretation (p.6 l.4-7). A modification in the description of page 6 is shown below. In addition, the classification is limited to two categories and the limitation in the method for this particular was added in the document as detailed also in Major comment #4 in this document.

Author's changes in manuscript

Before: Low damage or survived. For this classification, the visual interpretation focused on the structures with only small variations in geometry or roof shape. In addition, when there was no visual variation, but the structure was near an expected flooded area, the level was classified as low damage or survived.

After: Low damage or survived. For this classification, the visual interpretation focused on the structures with only small variations in geometry or roof shape. In addition, when there was no visual variation, **if** the structure was near an expected flooded area, the level was classified as low damage or survived **due to the uncertainty on damage by the storm surge and resistance of roof to the strong wind.**

Before: Some limitations to this method are its use of subjective interpretation, which can vary from user to user; that the availability of satellite images of the impacted area depends on weather conditions; and that it is time consuming.

After (added): In addition, underestimations in the interpretation of damage conditions due to storm surge inundation might occurred when the structure has not been damaged on its roof due to a high resistance to winds. In this study, it was confirmed later during field survey that the main roofing type is corrugated galvanized iron (CGI) sheets, which posses low resistance to strong winds.

Major comments #3

Though the authors concluded "the damage was confirmed qualitatively through field survey observations", it is lack in substance and conviction. More detailed analysis needs to be added to ascertain this most important conclusion.

Author's response

Thank you for your accurate comment and suggestion. We have modified a section of the conclusions to sum up the analysis and observations made within the manuscript in this regard. In addition, to stress the correlation of the remote sensing assessment and survey measurements a final statement was added following p.6 l.14 which is also detailed in Mayor comments #7 of this document.

Author's changes in manuscript

Before: This paper reports on two response activities conducted by IRIDeS after the impact of Super Typhoon Haiyan in the Philippines. First, a rapid damage assessment was conducted through satellite visual images, and then, the damage was confirmed qualitatively through field survey observations. The results of the interpretation and the findings of the field survey observations were presented in this paper.

After (added): The areas interpreted as high damaged during the satellite image inspection were confirmed as areas with higher storm surge inundations that those of low damaged interpreted areas. In addition, the high vulnerability of houses with lightweight roofing materials, and the presence of ships carried inland by the storm surge were the cause of devastation in the areas interpreted as high damaged. A qualitative spatial correlation of inundation heights and damage interpretation can be observe from Fig. 3 and Fig. 7, while the interpreted characteristics of heavy damage in the north district compared to the downtown areas in Tacloban was confirmed during field survey and shown in Fig. 4.

Major comments #4

The common roof type to be seen in the Philippines should be explained. If concrete roof is commonly used, the visual inspection may not be effective.

Author's response

As accurately mentioned, it is one of the limitations of the visual damage inspection method using satellite images. We added a description of this limitation when describing the method in page 5 line 11. In addition, the common roof type in the area of study is described in page 8 line 23 within the observations of the field survey.

Author's changes in manuscript

Before: Some limitations to this method are its use of subjective interpretation, which can vary from user to user; that the availability of satellite images of the impacted area depends on weather conditions; and that it is time consuming.

After (added): In addition, underestimations in the interpretation of damage conditions due to storm surge inundation might occurred when the structure has not been damaged on its roof due to a high resistance to winds. In this study, it was confirmed later during field survey that the main roofing type is corrugated galvanized iron (CGI) sheets, which posses low resistance to strong winds.

Major comments #5

Both the results of visual inspection and damaged (or non-damaged) houses should be compared in the same figure. For instance, Figs 3 and 4 can be merged into a single figure.

Author's response

We appreciate the reviewer comments on this point, however we agreed that it is necessary to keep Figure 3 and Figure 4 as separate figures. The structure of the paper suggests two stages of response to the event. (1) The rapid damage assessment using remote sensing conducted before the field survey having Fig. 3 as the main outcome. (2) The report on findings from the field survey to qualitatively (photos) verify the first stage and to grasp the impact of the storm surge having Fig. 4 and followings as the main outcomes of this stage. A figure that combines the information provided by Figure 3 and Figure 4 might be overwhelming and confusing for the reader.

Author's changes in manuscript

No changes were made in the manuscript.

Major comments #6

Indeed, visual inspection is straightforward. However, still the authors should more carefully describe the procedure how to distinguish either damage or not. The authors may include some photos to exemplify the separation.

Author's response

The criteria for classification during the visual inspection of satellite imagery are described in page 6 lines 1 to 5. In addition, Figure 2 was replaced for better visibility of pre and post conditions used in the interpretation from satellite images. Also, Figure 4 contributes with photos as example of high damage or non-damage found during the field survey

Author's changes in manuscript

No changes were made in the manuscript.

Major comments #7

Though the authors carried out a field survey and measured storm surge inundation (Fig.7), it seems that the result was not substantially utilized in interpreting the building damage. It may be possible to somehow correlate between these two things.

Author's response

The building damage interpretation was conducted at an early stage as a rapid response effort before the dispatch of the survey team. The measurements and observations gathered from the survey were useful to qualitatively evaluate the accuracy of the rapid assessment of building damage, as mentioned in p.6 l.9-14.
However, to stress the correlation of the remote sensing assessment and survey measurements a final statement was added following p.6 l.14

Author's changes in manuscript

Before: During our field survey, we visually confirmed the extensive damage in these areas. The verification of our interpretation is, at this moment, qualitative due to the difficulties experienced during the field survey in gathering detailed information at a house-by-house resolution (Fig. 4). The extensive damage interpreted to the north and south of the downtown was confirmed to be due to the high vulnerability of the structures in these areas and to the presence of stranded ships, which caused most of the damage near the Anibong area (Fig. 5)

After (added): In addition, areas interpreted as high damage in Fig. 3 are correlated to high storm surge inundations measured in the survey and shown in Fig. 7.

Minor corrections #1

Page 3743 Line 5: Eight regions –IV, V, VI, VIII, X, XI, XIII should be deleted unless the regions are indicated on map.

Author's response

We agreed on the reviewer suggestions. The details of regions were deleted and a modification on the text was conducted to show the magnitude of the impact in the Philippines.

Author's changes in manuscript

Before: "Eight regions – IV, V, VI, VIII, X, XI, XIII – were affected […]

Now: Eight **out of seventeen** regions were affected […]

Minor corrections #2

Fig.2: Date when these satellite images taken should be included.

Author's response

The date for the post-event image was already included within the text in "Data description", however we agreed to modified the caption and the text to specify these information.

Author's changes in manuscript

Caption Before: (A) Pre-event satellite image obtained from a mosaic of Google Earth snapshots. (B) Post-event Pleiades/Astrium service satellite image. In addition, a Digital Globe image in Google Earth was used for areas in the northern part of the study area.

Caption Now: (A) Pre-event satellite image obtained from a mosaic of Google Earth snapshots **(Imagery Date: 23 Feb. 2012)**. (B) Post-event Pleiades/Astrium service satellite image. In addition, a Digital Globe image in Google Earth was used for areas in the northern part of the study area **(Imagery Date: 13 Nov. 2013)**.

Text Before: Pre-event satellite imagery of Tacloban city was readily accessible through Google Earth, while post-event remote sensing data of the damaged area was obtained on 13 November 2013 through Digital Globe in Google Earth and through CNES Pleiades/Astrium imagery from the ArcGIS Map Service.

Text Now: Pre-event satellite imagery of Tacloban city **taken on 23 February 2012** was readily accessible through Google Earth, while post-event remote sensing data of the damaged area was obtained on 13 November 2013 through Digital Globe in Google Earth and through CNES Pleiades/Astrium imagery from the ArcGIS Map Service.

Minor corrections #3

Fig.2 (B): As the cloud covering the photo decrease visibility, it is hard to realize what this photo tries to indicate. Thus, I recommend using another photo with more visibility or more focus a region of special interest (e.g. downtown area).

Author's response

Thank you for the accurate recommendation. The image was changed showing the whole area and a zoomed area for better visibility.

Author's changes in manuscript

Figure 2 Before:

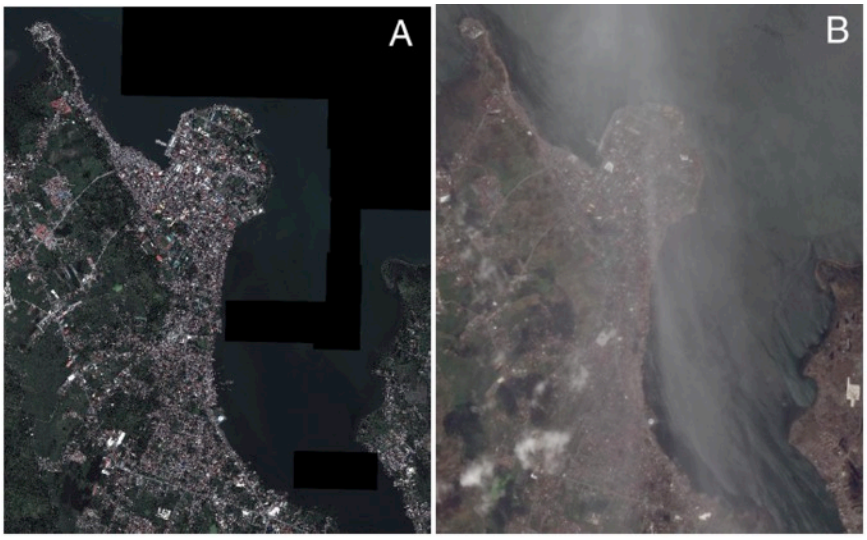
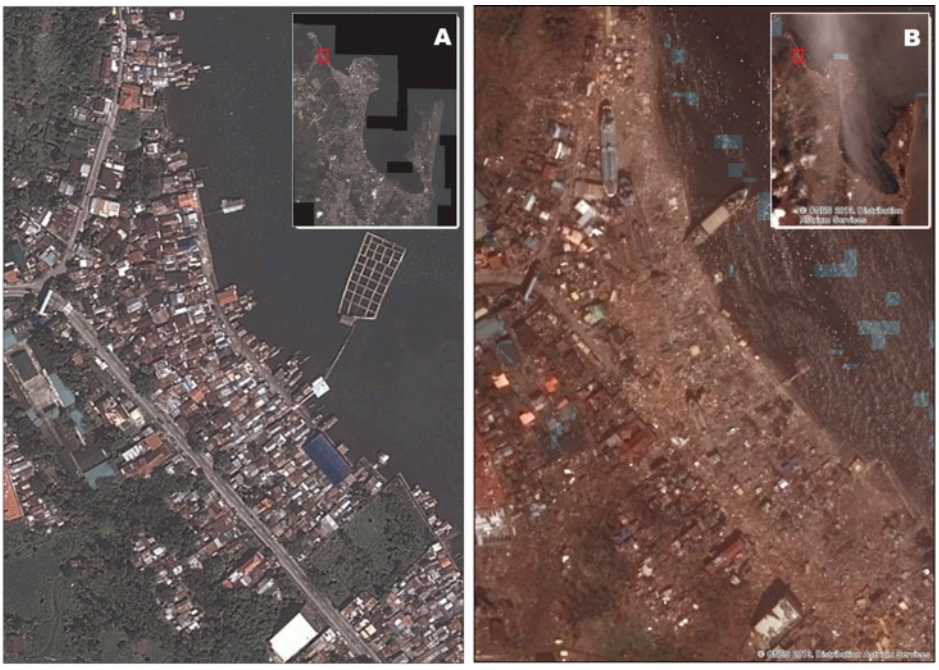


Figure 2 After:



Minor corrections #4

Fig.3: Better to use two colors with more contrast, rather than red and orange.

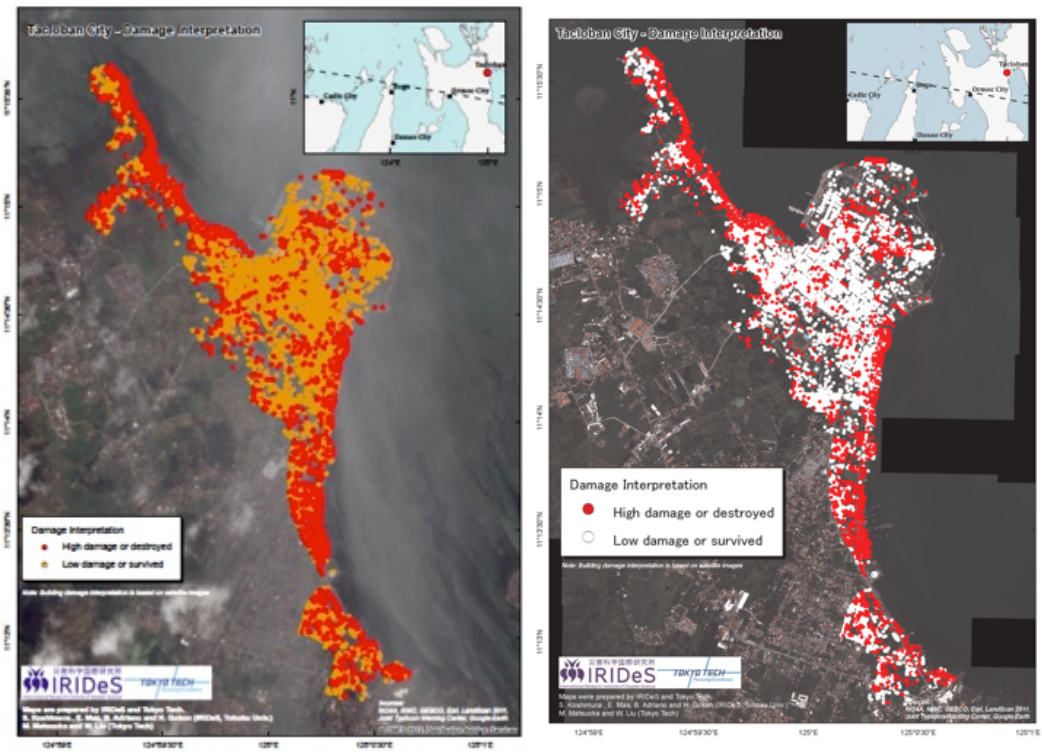
Author's response

Thank you for the accurate recommendation. The image was changed as shown below.

Also the caption was corrected.

Author's changes in manuscript

Figure 3 Before and After:



Minor corrections #5

Fig.13: Is "surface wave" correct term?

Author's response

"Surface waves" refers to the surface gravity waves or waves on top of the storm surge that mainly affected the area of Guiuan. The term is correct.

An example reference using these concepts is:

Mulligan, R., Walsh, J., and Wadman, H. (2014). "Storm Surge and Surface Waves in a Shallow Lagoonal Estuary during the Crossing of a Hurricane." J. Waterway, Port, Coastal, Ocean Eng. , 10.1061/(ASCE)WW.1943-5460.0000260 , A5014001.

Author's changes in manuscript

No changes were made in the manuscript.